

What is claimed is:

1. A mobile communications system composed of a plurality of sub-networks and for enabling a correspondent terminal to communicate with a mobile terminal, the mobile terminal may  
5 move from one sub-network to another sub-network,  
comprising:

an authentication unit for authenticating said correspondent terminal;

10 a setting unit for setting communication parameters  
that the correspondent terminal requires to communicate with the mobile terminal and updating the communication parameters when the mobile terminal moves from a first sub-network to a second sub-network; and

15 a communicating unit for communicating between network  
controlling devices in order to set the communication parameters.

2. The mobile communications system according to claim 1, wherein a Mobile IP is adopted as a communication  
20 protocol.

3. The mobile communications system according to claim 2, wherein said correspondent terminal does not support the Mobile IP protocol.

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4. The mobile communications system according to claim 2, further comprising:

5 a tunneling unit for editing a data packet received from said correspondent terminal and destined for the mobile terminal and for transmitting the edited data packet directly to the first sub-network when said correspondent terminal exists in the first sub-network and the mobile terminal exists in the second sub-network.

10 5. The mobile communications system according to claim 1, wherein said correspondent terminal is a terminal which can move from one sub-network to another sub-network.

15 6. The mobile communications system according to claim 1, further comprising:  
a router coupled to said correspondent terminal, wherein said setting unit and said communicating unit are arranged in said router.

20 7. The mobile communications system according to claim 2, further comprising:

visit state verifying means for determining whether or not said correspondent terminal exists in a predetermined area.

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8. The mobile communications system according to claim 7, wherein

if said correspondent terminal does not exist in the predetermined area, the communication parameters for said correspondent terminal are deleted.

9. The mobile communications system according to claim 2, wherein

if said correspondent terminal is a Mobile IP correspondent terminal, said correspondent terminal is determined to have left a predetermined area when the correspondent terminal does not make a registration in the predetermined area.

10. The mobile communications system according to claim 7, wherein

said visit state verifying means determines that said correspondent terminal no longer exists in the predetermined area by detecting that packets relating to said correspondent terminal are not transmitted and received.

11. A mobile communications method for enabling a correspondent terminal to communicate with a mobile terminal in a network composed of a plurality of sub-networks having

network controlling devices, and for continuing to  
communicate even when the mobile terminal moves from one  
sub-network to another sub-network, comprising the steps of:

authenticating the correspondent terminal;

5           setting communication parameters that the  
correspondent terminal requires to communicate with the  
mobile terminal;

          updating the communication parameters when the  
mobile terminal moves from a first sub-network to a second  
10   sub-network; and

          communicating the communication parameters  
between the network controlling devices in order to set the  
communication parameters.

15           12. The mobile communications method according to  
claim 11, wherein a Mobile IP protocol is adopted as a  
communication protocol in the mobile communications method.

          13. The mobile communications method according to  
20   claim 12, wherein the correspondent terminal does not  
support the Mobile IP protocol.

          14. The mobile communications method according to  
claim 12, further comprising the steps of:

25           editing a data packet received from the

correspondent terminal and destined for the mobile terminal;  
and

transmitting the edited data packet directly to the  
second sub-network, and making the data packet reach the  
5 mobile terminal, when the correspondent terminal exists in  
the first sub-network and the mobile terminal exists in the  
second sub-network.

15. The mobile communications method according to  
10 claim 11, wherein the correspondent terminal is a terminal  
which can move among the plurality of sub-networks.

16. The mobile communications method according to  
claim 11, wherein the setting and communicating steps are  
15 performed in a router coupled to the correspondent terminal.

17. The mobile communications method according to  
claim 12, further comprising the step of:

determining whether or not the correspondent  
20 terminal exists in a predetermined area, wherein the  
predetermined area is an area where the correspondent  
terminal may access the network.

18. The mobile communications method according to  
25 claim 17, wherein

if the correspondent terminal does not exist in the predetermined area, the communication parameters for the correspondent terminal are deleted.

5           19. The mobile communications method according to claim 12, further comprising the step of:

                  if the correspondent terminal is a Mobile IP correspondent terminal, determining that the correspondent terminal has left a predetermined area when the  
10 correspondent terminal does not make a registration to the predetermined area.

                  20. The mobile communications method according to claim 17, wherein

15                   the visit state verifying step determines that the correspondent terminal no longer exists in the predetermined area by detecting that packets are not transmitted and received by the correspondent terminal.

20           21. In a proxy correspondent node, a method of providing a communication service to a correspondent terminal that communicates with a mobile terminal, comprising the steps of:

                  hunting binding information about the mobile terminal,  
25 the binding information being transferred from a home agent

of the mobile terminal to the correspondent terminal, and  
processing a data packet from the correspondent  
terminal to the mobile terminal based on the binding  
information.

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22. The method of claim 21, further comprising the  
step of:

tunneling the data packet from the correspondent  
terminal to the mobile terminal based on the binding  
10 information, the binding information being information which  
provides a correspondence between an IP address of the  
mobile terminal and an IP address of a foreign agent that is  
accommodating the mobile terminal.

15 23. A mobile communications method for registering a  
correspondent terminal and enabling the correspondent  
terminal to communicate with a mobile terminal in a network  
composed of a plurality of sub-networks and for continuing  
to communicate even when the mobile terminal moves from one  
20 sub-network to another sub-network, comprising the steps of:

receiving a connection request from the  
correspondent terminal;

authenticating the correspondent terminal;

retrieving a service profile of the correspondent  
25 terminal;

generating a visitor list entry for the  
correspondent terminal based on a service profile and  
binding cache information relating to path optimization; and  
returning a registration acknowledgment to the  
5 correspondent terminal.

24. A proxy correspondent node device which verifies  
the state of a correspondent terminal when the correspondent  
terminal is registered with a network and the correspondent  
10 terminal may communicate with a mobile terminal in a network  
composed of a plurality of sub-networks and continues to  
communicate even when the mobile terminal moves from one  
sub-network to another sub-network, comprising:

means for setting a visit state flag to an active  
15 state when the correspondent terminal is transmitting  
packets during a registration process;

means for monitoring the flow of packets  
transmitted from the correspondent terminal;

means for setting the visit state flag to a  
20 pending state when the monitoring does not detect a packet  
flow for a predetermined time period;

means for setting the visit state flag to a left  
area state when the monitoring does not detect a packet flow  
for another predetermined time period and the visit state  
25 flag is in the pending state;



means for setting the visit state flag to the active state when the monitoring detects a packet flow when the visit state flag is in the pending state and before the another predetermined time period; and

5 means for deleting a visitor list entry for the correspondent terminal based on a service profile and binding cache information relating to path optimization when the visit state flag is in the left area state.

10 25. A proxy correspondent node device which verifies the state of a correspondent terminal when the correspondent terminal is registered with a network and the correspondent terminal may communicate with a mobile terminal in a network composed of a plurality of sub-networks and continues to  
15 communicate even when the mobile terminal moves from one sub-network to another sub-network, comprising:

means for setting a visit state flag to an active state when the correspondent terminal is transmitting packets during a registration process;

20 means for detecting a packet transmitted from the correspondent terminal;

means for setting a timestamp indicating the time of transmission of the detected packet;

25 means for monitoring a time difference between the timestamp and a current time;

means for determining the correspondent terminal no longer transmitting packets when the time difference is greater than a predetermined value; and

means for deleting a visitor list entry for the  
5 correspondent terminal based on a service profile and binding cache information relating to path optimization when the visit state flag is in the left area state.

26. A mobile communications method for providing  
10 service control and path optimization of a correspondent terminal communicating with a mobile terminal in a network composed of a plurality of sub-networks and for continuing to communicate even when the mobile terminal moves from one sub-network to another sub-network, comprising the steps of:  
15 authenticating the correspondent terminal;  
retrieving a service profile of the correspondent terminal;  
monitoring packets;  
determining whether the monitored packets are  
20 binding cache management messages corresponding to the correspondent terminal; and  
storing information received in the binding cache management messages in a proxy cache corresponding to the correspondent terminal.

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27. The mobile communications method of claim 26,  
further comprising the step of:

performing operations and functions which are  
requested by the correspondent terminal according to the  
5 stored information and the service profile information.

28. The mobile communications method of claim 26,  
wherein the determining step further includes:

determining whether the monitored packets are binding  
10 cache management messages destined for the correspondent  
terminal, and when determined that the binding cache  
management messages are destined for the correspondent  
terminal and a corresponding entry in the proxy cache does  
not currently exist, then  
15 generating the corresponding entry in the proxy cache;  
further generating a binding acknowledge message; and  
transmitting the generated message to a home agent of  
the mobile terminal.

20 29. A proxy communication unit providing communication  
services for a correspondent terminal that is communicating  
with a mobile terminal through a communication network, said  
proxy communication unit being part of the communication  
network, said proxy communication unit comprising:

25 a controller for authenticating the correspondent

terminal, verifying and setting the services to be provided to the correspondent terminal and issuing a communication authorization to the correspondent terminal; and

5 a message handling unit for generating and receiving packets to and from distributed physical nodes to exchange information required in providing the communication services for the correspondent terminal that is communicating with the mobile terminal, including verifying and setting the services to be provided to the correspondent terminal among the distributed physical nodes.

30. The proxy communication unit of claim 29, further comprising:

15 a link layer authenticating server for providing authenticating information to said controller; and a service profile database that stores a service profile of the correspondent terminal.

31. The proxy communication unit of claim 30, wherein a service profile of the correspondent terminal comprises an identifier for the correspondent terminal, and a service block that describes the specific services to be provided to the correspondent terminal.

25 32. The proxy communication unit of claim 31,

wherein the service block includes a service type, policy information and information specific to the type of service to be provided.

5           33. The proxy communication unit of claim 29, wherein the controller further comprises:

          a cache management unit for storing and managing a binding cache corresponding to the correspondent terminal and containing information of the mobile terminal.

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          34. The proxy communication unit of claim 33, wherein the cache management unit further comprises:

          a detecting unit for detecting and receiving a binding cache message corresponding to the correspondent terminal and containing information of the mobile terminal;

          a generating unit for generating an entry in a cache table if an entry containing the received binding cache information does not exist; and

          an updating unit for updating the cache table with the received binding cache information if an entry does exist.

          35. The proxy communication unit of claim 34, further comprising:

a cache storage unit for storing at least one of the cache table, a visitor list and the service profile.

36. The proxy communication unit of claim 29, wherein  
5 the controller further comprises:

a tunneling unit for generating a tunnel packet including a care-of-address of the mobile terminal.

37. The proxy communication unit of claim 29, wherein  
10 the controller further comprises:

a mobile agent unit for dynamically registering and deleting a registration of the correspondent terminal where the correspondent terminal implements a mobile IP protocol as a communication protocol.

38. The proxy communication unit of claim 29, wherein  
15 the controller further comprises:

a visit state unit for verifying that the correspondent terminal is still in an area where the proxy  
20 communication unit provides communication services for the correspondent terminal.

39. The proxy communication unit of claim 38, wherein  
the visit state unit comprises:

25 a packet monitoring unit for monitoring packet

transmission from the correspondent terminal, wherein when a packet from the correspondent terminal is not detected for a predetermined period of time the correspondent terminal is determined to have left the area where the proxy

5 communication unit provides communication services for the mobile terminal and the proxy communication unit deletes a registration of the correspondent terminal.

40. The proxy communication unit of claim 38, wherein  
10 the visit state unit comprises:

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a packet monitoring unit for monitoring packet transmission from the correspondent terminal and setting a visit state flag to a pending state when a packet from the correspondent terminal is not detected for a predetermined  
15 period of time; and

a determination timer, started when the visit state flag changes to the pending state, wherein when the packet monitoring unit does not detect any packets from the correspondent terminal before the determination timer  
20 expires the visit state flag is set to out of area and the proxy communication unit deletes a registration of the correspondent terminal.

41. The proxy communication unit of claim 38, wherein  
25 the visit state unit comprises:

a packet monitoring unit for monitoring packet transmission from the correspondent terminal and storing a time of transmission of a packet, wherein when a difference between a present time and the time of transmission is greater than a predetermined period of time the correspondent terminal is determined to have left the area where the proxy communication unit provides communication services for the mobile terminal and the proxy communication unit deletes a registration of the correspondent terminal.

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42. A proxy correspondent node device (proxy CN) which forms a communication system with a correspondent terminal, and provides communication services for a correspondent terminal that is communicating with a mobile node, said proxy CN being part of a communication network, said proxy CN comprising:

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a first communication port for communicating with the correspondent terminal;

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a second communication port for communicating with the communication network; and

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a controller for controlling the transmitting/receiving of messages in the first communication port and the second communication port and for receiving a request message from the correspondent terminal to communicate with the mobile node, authenticating the



correspondent terminal, verifying and setting the services to be provided to the correspondent terminal and issuing a communication authorization to the correspondent terminal.

5           43. The proxy CN device of claim 42, wherein the controller when authenticating the correspondent terminal accesses a link layer authenticating server for providing authenticating information to said controller; and a service profile database that stores a service profile of the  
10 correspondent terminal.

          44. The proxy CN device of claim 42, wherein the controller further comprises:

                  a cache management unit for storing and managing a  
15 binding cache corresponding to the correspondent terminal and containing information of the mobile node.

          45. The proxy CN device of claim 44, wherein the cache management unit further comprises:

20                   a detecting unit for detecting and receiving a binding cache message corresponding to the correspondent terminal and containing information of the mobile node;

                  a generating unit for generating an entry in a cache table if an entry containing the received binding  
25 cache information does not exist; and

an updating unit for updating the cache table with the received binding cache information if an entry does exist.

5           46.     The proxy CN device of claim 45, further comprising:

            a cache storage unit for storing at least one of the cache table, a visitor list and the service profile.

10           47. The proxy CN device of claim 42, wherein the controller further comprises:

            a tunneling unit for generating a tunnel packet including a care-of-address of the mobile node.

15           48. The proxy CN device of claim 47, wherein the tunneling unit encapsulates a packet received from the correspondent terminal and destined for the mobile node within another packet with the care-of-address of the mobile node.

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            49. The proxy CN device of claim 42, wherein the controller further comprises:

            a message handling unit for generating and receiving packets to and from distributed physical nodes to  
25     exchange information required in providing the communication

services for the correspondent terminal that is communicating with the mobile node, including verifying and setting the services to be provided to the correspondent terminal among the distributed physical nodes.

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50. The proxy CN device of claim 42, wherein the controller further comprises:

10 a mobile agent unit for dynamically registering and deleting a registration of the correspondent terminal where the correspondent terminal implements the mobile IP protocol in communicating with the proxy CN device.

51. The proxy CN device of claim 42, wherein the controller further comprises:

15 a visit state unit for verifying that the correspondent terminal is still in an area where the proxy CN device provides communication services for the correspondent terminal.

20 52. A proxy correspondent node device to accommodate a correspondent terminal which makes a communication with a mobile terminal, comprising:

25 means for hunting binding information about the mobile terminal, which is transferred from the home agent of the mobile terminal to the correspondent terminal; and

means for processing data packets from the correspondent terminal to the mobile terminal based on the binding information.

5           53. The proxy correspondent node device of claim 52, further comprising:

              means for transmitting a binding acknowledge message to the home agent, which has a request to the home agent that subsequent binding information should be  
10      transmitted to the proxy correspondent node device.

              54. A correspondent terminal to communicate with a mobile terminal via a proxy correspondent node device, comprising:

15           means for detecting a binding information from a home agent which is accommodated in the same network as the mobile terminal is accommodated; and

              means for transferring the binding information to the proxy correspondent node device.

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